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Assessing Strength of Pelvic Floor Muscle in Pelvic Organ Prolapse

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ABSTRACT

Introduction: Pelvic organ prolapse is a debilitating condition affecting around 75% of women of different age group and parity. Most women with pelvic organ prolapse also have damage of pelvic floor muscle. Reduced pelvic floor muscle strength in pelvic organ prolapse is associated with worse symptoms and prognosis.

Objectives: This study aimed to determine the association between pelvic floor muscle strength and pelvic organ prolapse.

Methodology: A cross sectional study involving 145 women with pelvic organ prolapse was conducted in the outpatient department of Paropakar Maternity and Women's Hospital from 1st February 2024 to 30th April 2024. .Pelvic organ prolapse quantification and Modified Oxford Scale were used for staging and muscle strength assessment respectively. Collected data was analyzed using Statistical Package for Social Sciences version 23 and Chi-square test of independence was used to determine the statistical significance association($p<0.05$)

Results: Among the 145 women assessed, the majority 77(53.1%) had stage III pelvic organ prolapse, followed by 42(29%) with stage II and 17(9.7%) with stage IV.The Mean ±SD on the Modified Oxford Scale was 3.26±1.2. There was a statistically significant association between pelvic organ prolapse and pelvic floor muscle strength (p-value 0.006).

Conclusion: There is a significant association between pelvic organ prolapse and pelvic floor muscle strength. Women with weaker pelvic floor muscles were more likely to experience higher stages of prolapse. The findings highlight the crucial role of pelvic floor muscle strength in managing and potentially preventing the progression of POP.

INTRODUCTION

Pelvic organ prolapse (POP) is the descent of the apex of the vagina or cervix (or vaginal vault after hysterectomy), anterior or posterior vaginal wall affecting about 75% of women across various ages and parities.[1,2] Normal support of the pelvic organs relies on the integrity of the pelvic floor muscles (PFMs), the supportive connective tissue of the vagina (including the endopelvic fascia,uterosacral and cardinal ligaments), and normal innervation.[1]Stronger and thicker PFMs are thought to provide better support to the pelvic organs potentially reducing the risk of POP.[3] The strength of the puborectalis muscle can be assessed through digital palpation and quantified using the Modified Oxford Scale (MOS).[4] Dysfunction in the levator ani muscle is thought to contribute pelvic organ prolapse. When the muscular support is lost, the urogenital hiatus widens and stretches or tear connective tissue support under pressure leading to prolapse.[5]

The Pelvic Organ Prolapse Quantification (POP-Q) system, endorsed by the International Continence Society, is used for staging prolapse.[6] This study aims to determine

association between pelvic floor muscle strength and pelvic organ prolapse, with the goal of improving the management of pelvic floor dysfunction.

METHODOLOGY

A cross sectional study was conducted in the outpatient department of Paropakar Maternity and Women's Hospital, Thapathali, Kathmandu, Nepal during the period of 3 months from 1stFebruary 2024 to 30thApril 2024.Ethical approval was taken from Institutional Review Board(IRB), National Academy of Medical Sciences (NAMS) (Ref. No. 328/2080/81), hospital authority and respective unit chief before data collection. Participants were informed about the objective of the study and voluntary informed written consent was obtained from each. Among 8753 women attending gynecological OPD during the study period, a total 145 women were enrolled by convenient sampling technique. Participants were enrolled 6 days in a week except Saturday during the study period. Women diagnosed with different stages of pelvic organ prolapse were included in the study. Pregnant women and women with history of previous gynecological surgery were excluded from the study.Data was collected on participant's baseline history which includes caste/ethnicity, age, parity, last menstrual period(LMP), occupation, educational level, medical and surgical history, obstetric history, family history, drug history and recorded.

Women were instructed to empty the bladder and a detailed clinical examination was done. In general examination, women's general condition including level of consciousness, presence or absence of pallor, icterus, edema and vital signs were checked. Vaginal examination was performed in dorsal lithotomy position for each patient after their consent. The POP-Qwas employed to stage pelvic organ prolapse and MOS was used to assess pelvic floor muscle strength.

In POP-Q system, the measurements were taken from six different points in the vagina relative to the hymen, first at rest and then during Valsalva maneuver. Of these six points two are located on the anterior vaginal wall (Aa and Ba), two are located on the posterior vaginal wall (Ap and Bp), one is located at the anterior lip of cervix or at the vaginal cuff in post-hysterectomy women (C) and one is located in posterior fornix in women who have not had hysterectomy (D). The anatomic position of the six defined points were measured in centimeters proximal to hymen (negative number) or distal to hymen (positive number), with the plane of the hymen representing zero. Total vaginal length (TVL) was measured at rest.[6] The details are listed in Table 1and Table 2.

Pelvic floor muscle strength was assessed by inserting two fingers into the vagina at 4 and 8 o'clock position and asking the women to squeeze the pelvic floor muscle. The strength of pelvic floor muscle was quantified using Modified Oxford Scale as described in Table 3.[6,7]

Pelvic Organ Prolapse Quantification (POP-Q): [6]

Table 1: Possible Ranges of the Six Site-Specific POP-Q Measurements.

Points	Description	Range
Aa	Anterior wall 3cm from hymen	-3cm to +3cm
Ba	Most dependent portion of rest of anterior wall	-3cm to +TVL
C	Cervix or vaginal cuff	±TVL
D	Posterior fornix (if no prior hysterecto-my)	±TVL or omitted
Ap	Posterior wall 3cm from hymen	-3cm to +3cm
Bp	Most dependent portion of rest of posterior wall	-3cm to +TVL

TVL; total vaginal length

Table 2: Stages of Pelvic Organ Prolapse[6]

Stage 0	No prolapse is demonstrated. Points Aa, Ap, Ba, Bp are all-3cm, and point C is between total vaginal length (TVL) and –(TVL-2cm)
Stage I	The most distal portion of prolapse is greater than 1 cm above the level of the hymen
Stage II	The most distal portion of the prolapse is less than 1cm proximal or distal to the plane of the hymen
Stage III	The most distal portion of the prolapse protrudes more than 1 cm below the plane of the hymen but no further than 2cm less than the total vaginal length.
Stage IV	Complete to nearly complete eversion of the vagina. The most distal portion of the prolapse protrudes to greater than (TVL-2cm)

Table 3: Modified Oxford Scale[7]

Modified Oxford Scale	
Grade 0	No discernable PFM contraction
Grade 1	A flicker or pulsing under the examining finger-a very weak contraction
Grade 2	A weak contraction-an increase in tension in the muscle without any discernable lift or squeeze
Grade 3	A moderate contraction-characterized by a degree of lifting of the posterior vaginal wall and squeezing on the base of the finger with indrawing of the perineum
Grade 4	A good PFM contraction producing elevation of the posterior vaginal wall against resistance and indrawing of the perineum
Grade 5	A strong contraction of PFM

The obtained data was entered in Microsoft excel sheet daily. Coding was done and data was transferred to Statistical Package for social science (SPSS) version 23. Frequency and percentage was calculated. Chi-square test of independence was applied to find the statistical significant association between PFMs and POPs. P-value <0.05 was considered statistically significant.

RESULTS

During this study, a total of 145 pelvic organ prolapse women had been examined for pelvic floor muscle strength using MOS. The median age of the women was 62 years, with an age range of 26 to 87 years.Most of them, 95 (65.5%) belongs to age group ≥60 years with the highest number of stage III (50) and stage IV (11) POP belonging to this age group. Majority of the women were multiparous, 69 (47.6%) and grandmultiparous, 69 (47.6%) with the highest number of stage I (5), stage II (21), stage III (40) and stage IV (9) POP belonging to these two groups. A normal BMI was observed in 103 (7.1%) of women with highest number of stage I (7), stage II (28), stage III (55) and stage IV (9) POP belonging to this age group. Majority, 125 (86.2%) were postmenopausal state and smoking history was observed in 63(43.4%) More than half 77 (53.1%) had POP stage III.Mean ±SD Modified Oxford Scale was 3.26±1.2, Table 4.

There was significant association between POP and PFM strength when measured digitally according to a MOS (p-value 0.006) demonstrating the increased severity of POP with decrease in the PFM strength.Most cases of stage IIIand stage IV POP have MOS grade 1 and grade 2, Table 5.

Table 4: Comparison of baseline characteristics with Stages of Pelvic Organ prolapse (POP)

Characteristics	Pelvic Organ prolapse(POP) stages				
	I n (%) 12 (8.3)	II n (%) 42 (29)	IIII n (%) 77 (53.1)	IV n (%) 14 (9.7)	Total n (%)
Age in years					
<30	1	0	0	0	1(0.7)
30-39	1	2	3	0	6(4.1)
40-49	1	2	4	0	7(4.8)
50-59	4	9	20	3	36(24.8)
≥60	5	29	50	11	95(65.5)
Parity					
Nulliparous	1	1	1	0	3(2.1)
Primiparous	2	1	1	0	4(2.8)
Multiparous	5	19	40	5	69(47.6)
Grandmultiparous	4	21	35	9	69(47.6)
BMI (kg/m^2)					
Underweight (<18)	1	4	8	1	14(9.7)
Normal weight (18-24.9)	7	28	55	13	103(71)
Over weight(25-29.9)	4	9	11	0	24(16.6)
Obese (≥30)	0	1	3	0	4(2.8)
Menstrual status					
Premenopausal	3	6	10	1	20(13.8)
Postmenopausal	9	36	67	13	125(86.2)
Smoking Habit	1	19	32	11	63(43.4)

Table 5: Association of PFM strength and POP (n=145)

		POP Q Stage				Total n (%)	P Value*
		Stage 1 n (%)	Stage 2 n (%)	Stage3 n (%)	Stage4 n (%)		
MOS	Grade 0	2(18.2)	2(18.2)	5(45.5)	2(18.2)	11(100)	0.006
	Grade 1	0(0)	6(20.7)	16(55.2)	7(24.1)	29(100)	
	Grade 2	3(7.1)	8(19)	28(66.7)	3(7.1)	42(100)	
	Grade 3	6(14.6)	12(29.3)	21(51.2)	2(4.9)	41(100)	
	Grade 4	1(5.6)	11(61.1)	6(33.3)	0(0)	18(100)	
	Grade 5	0(0)	3(75)	1(25)	0(0)	4(100)	
Total		12(8.3)	42(29)	77(53.1)	14(9.7)	145(100)	

Note: % within MOS was taken.*Chi-square test of independence was employed. P value <0.05 was considered statistically significant.

DISCUSSION

In this study, pelvic floor muscle strength was associated with pelvic organ prolapse. Among 145 women assessed, the severity of POP correlated with weaker pelvic floor muscles.Most cases of stage III and stage IV POP have MOS of grade 1 and grade2. The findings of this study are contrary to previous study that reported no association between PFM strength and POP stage in Nepali women.[8]

Similar to this study pelvic floor muscle strength was strongly and independently associated with presence of Prolapse (p value <0.01).[9]487 (76%In the study the authors used twofinger vaginal palpations and graded the pelvic floor muscle strength from 1 to 4. The findings of this study contradicts the results of Nygaard et al, who did not find a reduced PFM strength in women with POP.[10]This discrepancy in the results may be caused by different methods of assessment. The study done by Ghetti et al,showed weak correlation between severity of prolapse and Oxford grading scale ($r = -0.16$, $p < 0.0001$) and levator hiatus(LH)size correlates more strongly to prolapse severity than assessment of PFM function by the Oxford grading scale.[11] The difference in the findings may be because of the interobserver variability of the findings as it is done by digital palpation method.

Despite digital examination, advanced technology like ultrasonography, electromyography (EMG), manometry (perineometry) and magnetic resonance imaging (MRI) also evaluate the PFMs function.[10]However, on resource limited facilities like ours, a simple examination digital examination using theMOS grading is quiet effective to assess the strength of PFMs and compare with POP. The study done by Moegni F. showed that the results of the MOS examination, which is a subjective examination based on operator experience, can provide performance that is consistent with objectiveperineomtryexamination.[12]However,the study done by Navarro et al(2017) showed manometry and dynamometry are more reliable tools than vaginal palpation (both the modified Oxford Grading Scale and the Levator ani testing) for the assessment of PFM strength in women with pelvic floor disorders.[13]

One study found that in a group of women with pelvic floor disorders, most were unable to contract their PFMs correctly with mean ±SD being 1.5 ±1.0 in contrast to the women in our group with POP-Q stage I to IV who had mean MOS of 3.26±1.2.[14] However the study done by Caagbay et al, found comparable mean MOS of 3.33±0.48.[8]Study done by Oversand et al(2015) showed mean MOS of 2.4 (SD 1.1, range 0-5) and MOS was strongly associated with subjective and objective POP ($P \leq 0.001$).[15]

PFM strength has been found to be independently associated with POP, suggesting that weaker pelvic floor muscles increases the risk of developing a POP by seven times .[16]Known risk factors of POP includes age, parity, weight of the largest infant delivered vaginally, family history, overweight, menopause, race, medication, heavy weight lifting, chronic increase in abdominal pressure caused by heavy physical work or lung disease and smoking.[2] Age, parity, PFMs and maximum birth weight were significantly associated with presence of pelvic organ prolapse in various studies.[9]487 (76%Most of the women in our study had stage II and stage III POP and were older in age which was in contrast to another study done where most cases had stage I and stage II POP belonging to younger age group.[8] But these findings are comparable to previously published studies on PFM strength and POP.[2,16]Samuelsson et al. (1999) reported that the prevalence of any form of pelvic organ prolapse increased with increasing age.[9]487 (76% These findings are comparable to this study. Similar to this study, in a study done by Ansari et al. POP was found to be more prevalent among multiparous women (93.3%, 140/150) as compared to primipara (6.7%, 10/150).[17] This signifies the role of pelvic floor muscle injury during childbirth in causing POP. In the present study, maximum cases of POP were normal weight (71%).These findings contradicts findings of the study done by Ansari et al. as majority (42.7%)of patients were found to be obese.[17] Similarly in a study done by Braekken et al, BMI was independently related to POP.[16]

The frequency of pelvic organ prolapse following menopause varies considerably between studies. Similar to this study, the study done by Shi et al. (2023) showed that menopausal females have more symptomatic POP as compared to pre-menopausal females.[18] This may be because of lack of estrogen in postmenopausal women, causing reduction in strength of connective tissue supporting the pelvic organs.

Women with weaker pelvic floor muscles were more likely to experience higher stages of prolapsein this study. So assessing the strength of PFM is crucial in determining the best treatment option for women with POP. The first line non-surgical treatment approach for POP is PFM training as this has been shown to increase the strength of PFMs improving both symptoms and POP stage.[19]parallel group, randomized, controlled trial conducted at a university hospital and a physical therapy clinic randomly assigned 109 women with prolapse stages I, II, and III to pelvic floor muscle training (n = 59

CONCLUSION

The study revealed a significant association between pelvic organ prolapse (POP) and pelvic floor muscle strength. Women with weaker pelvic floor muscle were more likely to experience higher stages of prolapse. The findings highlight the crucial role of pelvic floor muscle strength in managing and potentially preventing the progression of POP.

RECOMMENDATIONS

Pelvic floor muscle strength plays crucial role in preventing the progression of pelvic organ prolapse. For generalizability of the findings, the study can be conducted in diverse population with larger sample size with probability sampling technique. Advanced tests like ultrasonography, electromyography, manometry (perineometry) and magnetic resonance imaging can be used for diagnostic accuracy.

LIMITATION OF THE STUDY: The study's limitations include the use of a convenience sample from a single hospital, which may

limit the generalizability of the findings to broader populations. The reliance on digital palpation for muscle strength assessment, while commonly used, may introduce subjective bias, affecting the accuracy of the results. Focused only on PFMS and POP, other factors like age, menstrual history, parity's association were not shown with POP which acts as confounding factor to establish the causal association of PFMS with POP.

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CONFLICT OF INTEREST:

The authors have no conflict of interest.

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